



Muon g-2 Detectors

Muon g-2 PGM
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Detector L2 Manager



U.S. DEPARTMENT OF
ENERGY

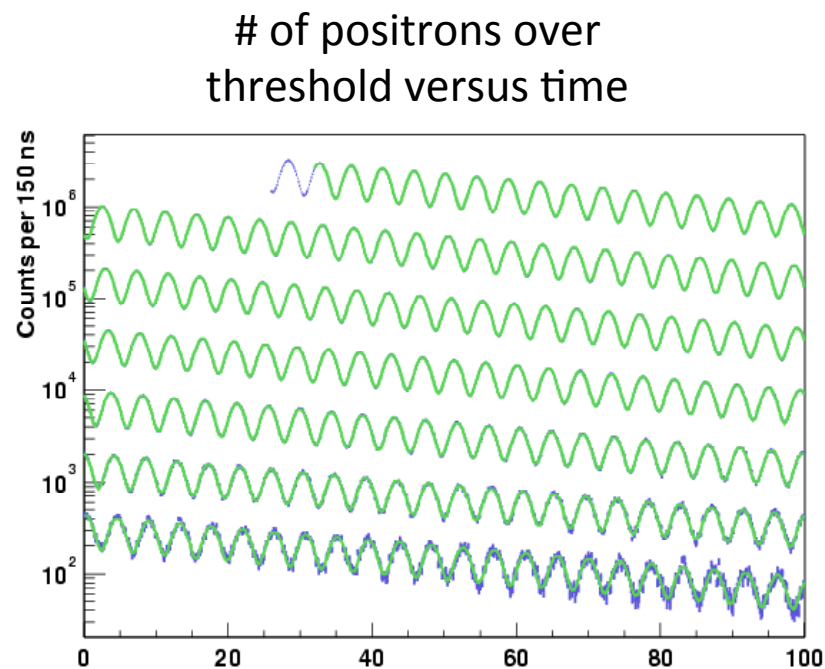
Office of
Science



Detector Physics Goals



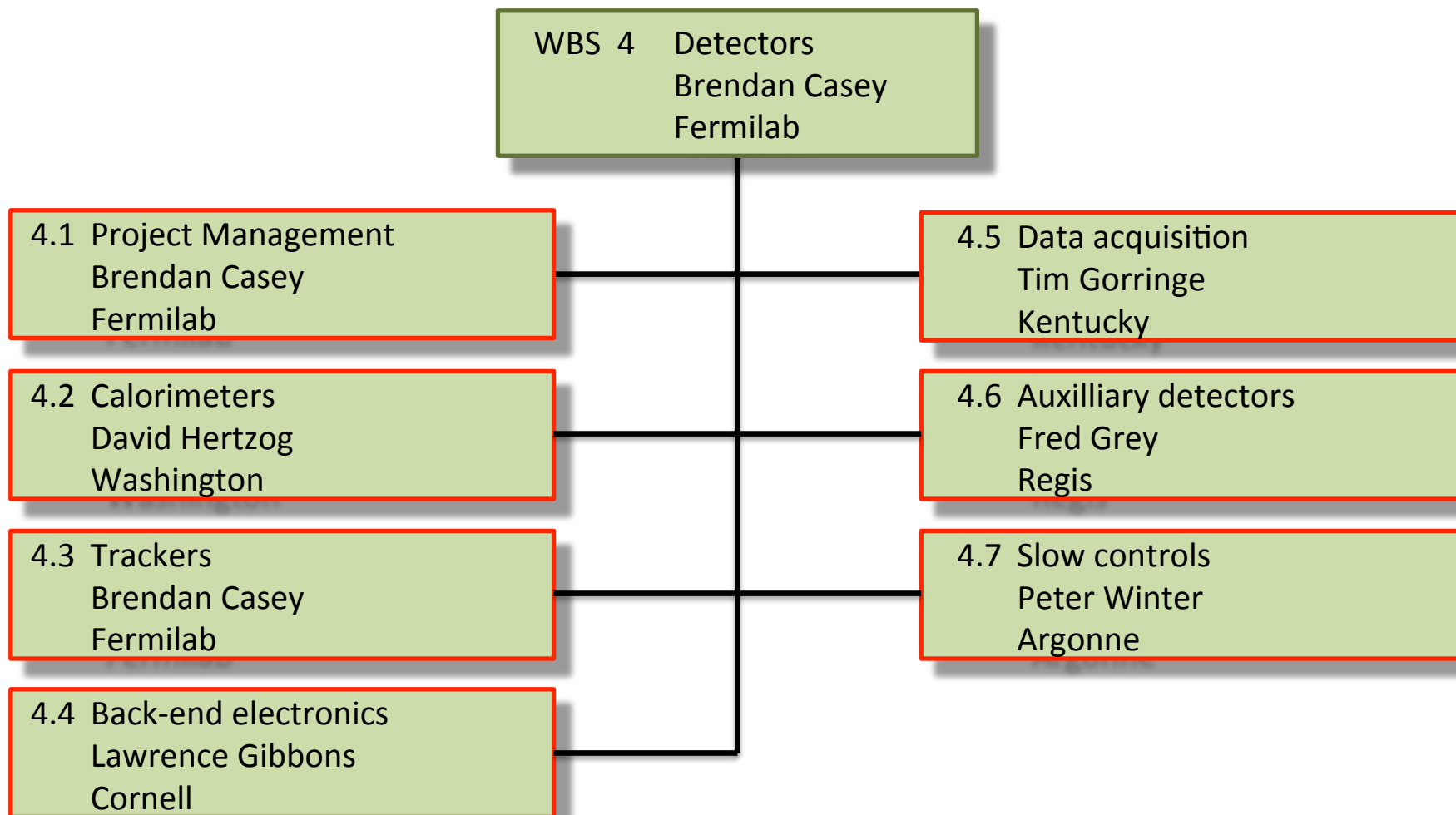
- The L2 detector branch of the WBS contains all instrumentation required to measure the muon precession frequency
- This includes:
 - Calorimeters to measure positron energy and time
 - This data is fit to extract the precession frequency
 - Tracking and other auxiliary detectors to measure characteristics of the muon beam
 - This data is used to make corrections to the extracted precession frequency and help constrain systematics
 - Readout electronics, data acquisition, and slow controls



This plot x 20

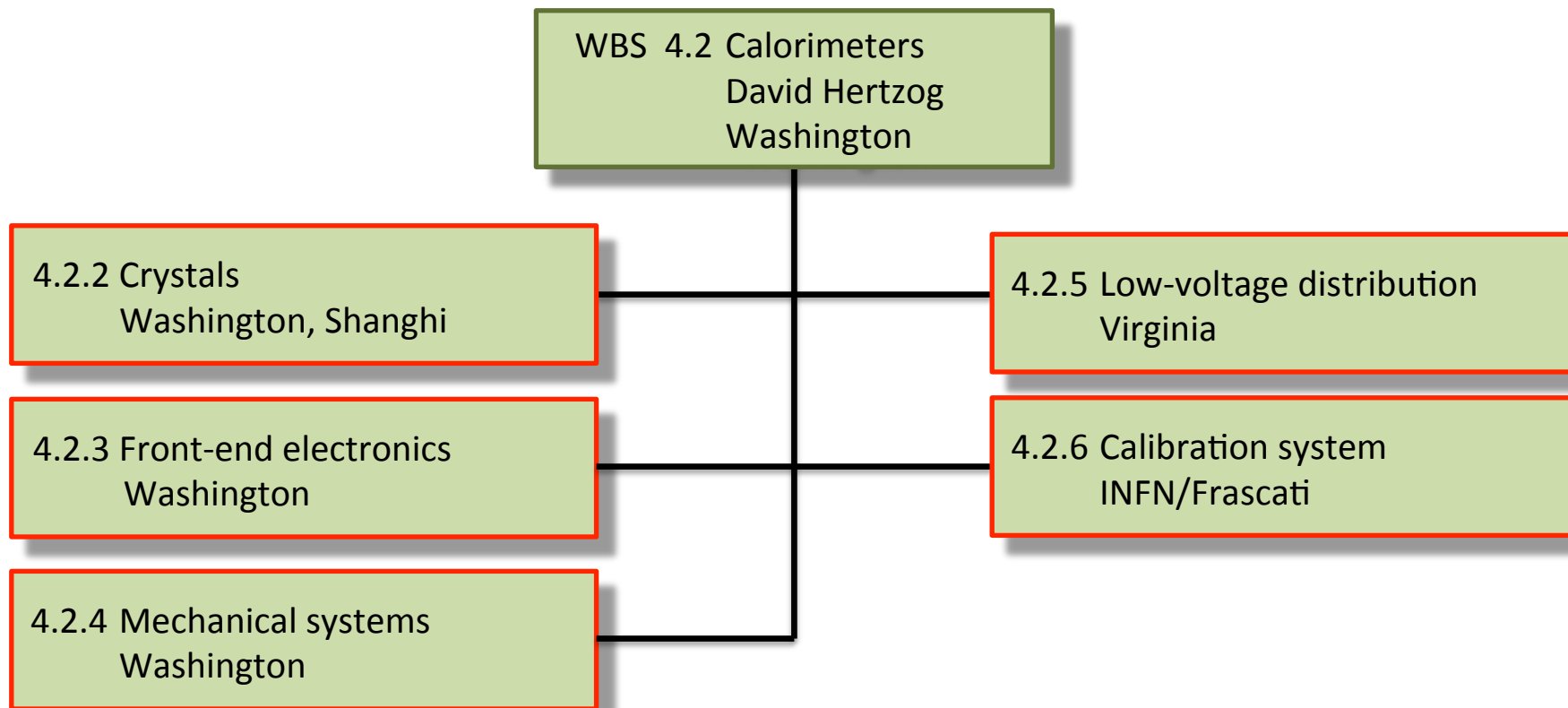


Detector Scope



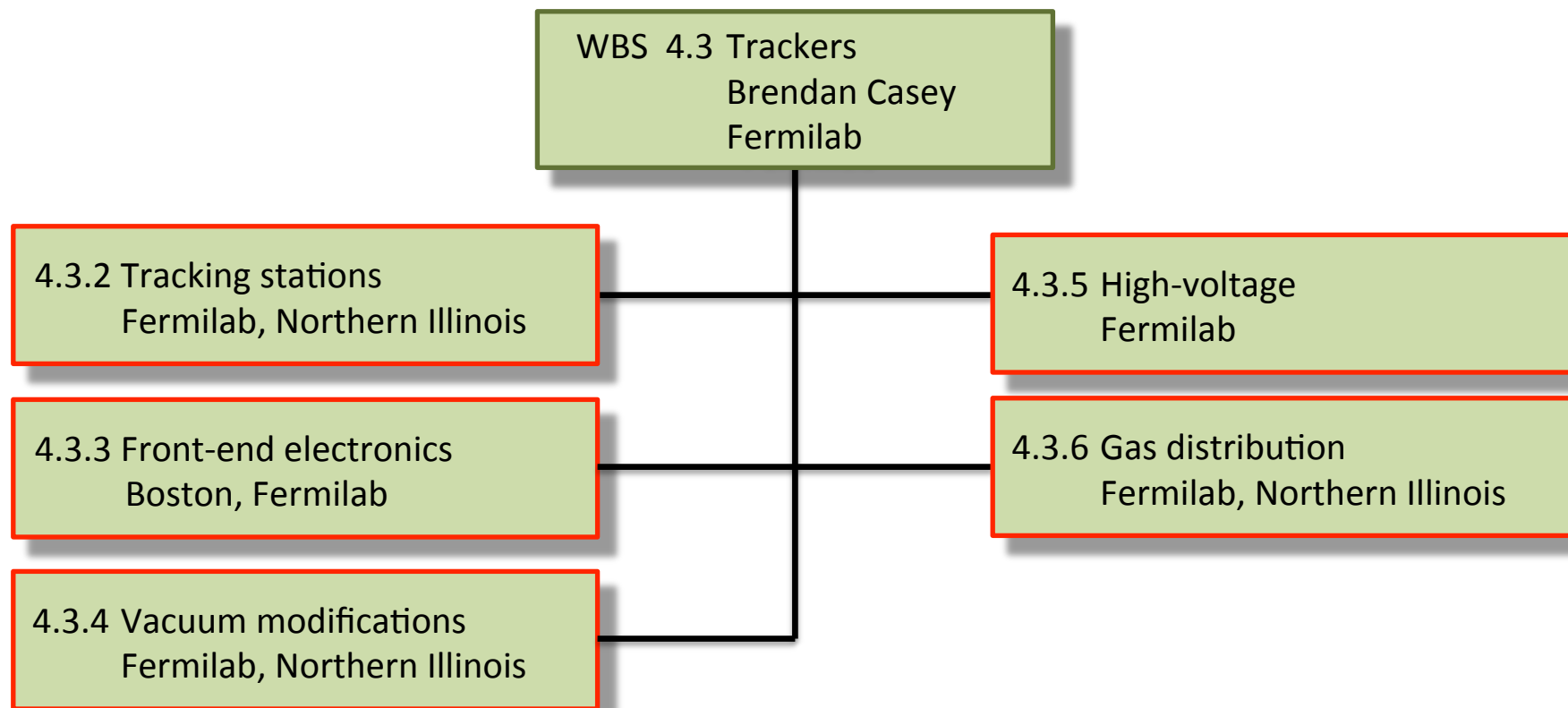


Calorimeter Scope



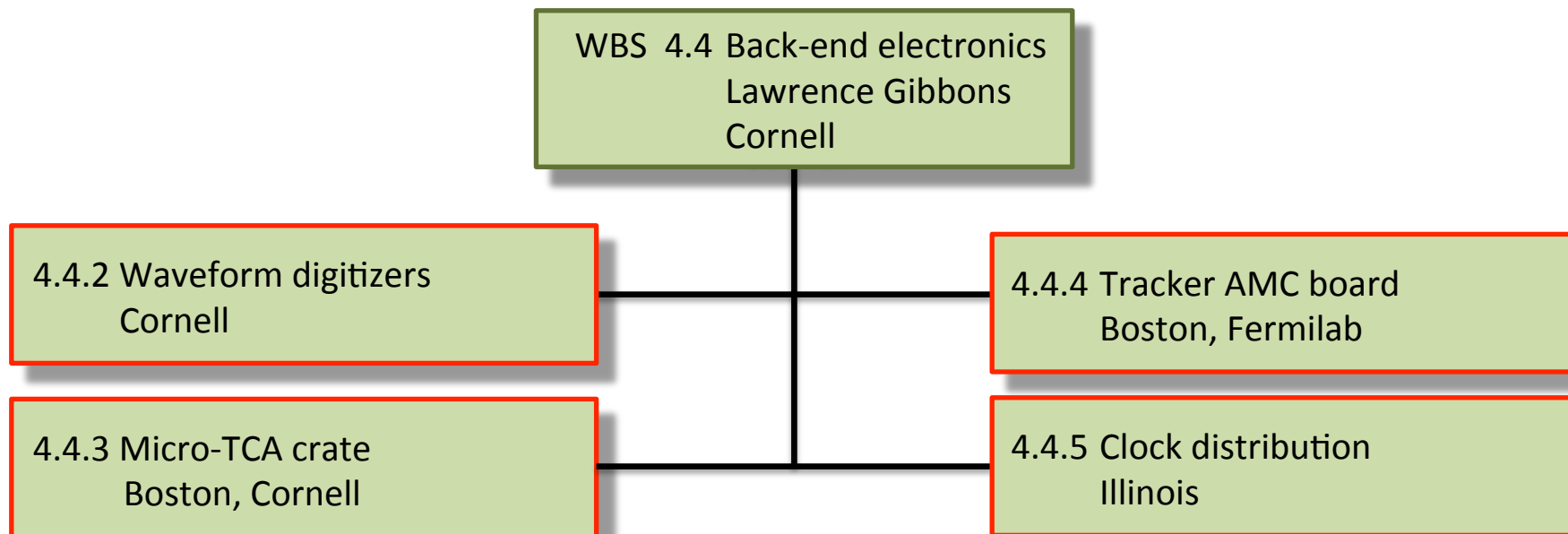


Tracker Scope



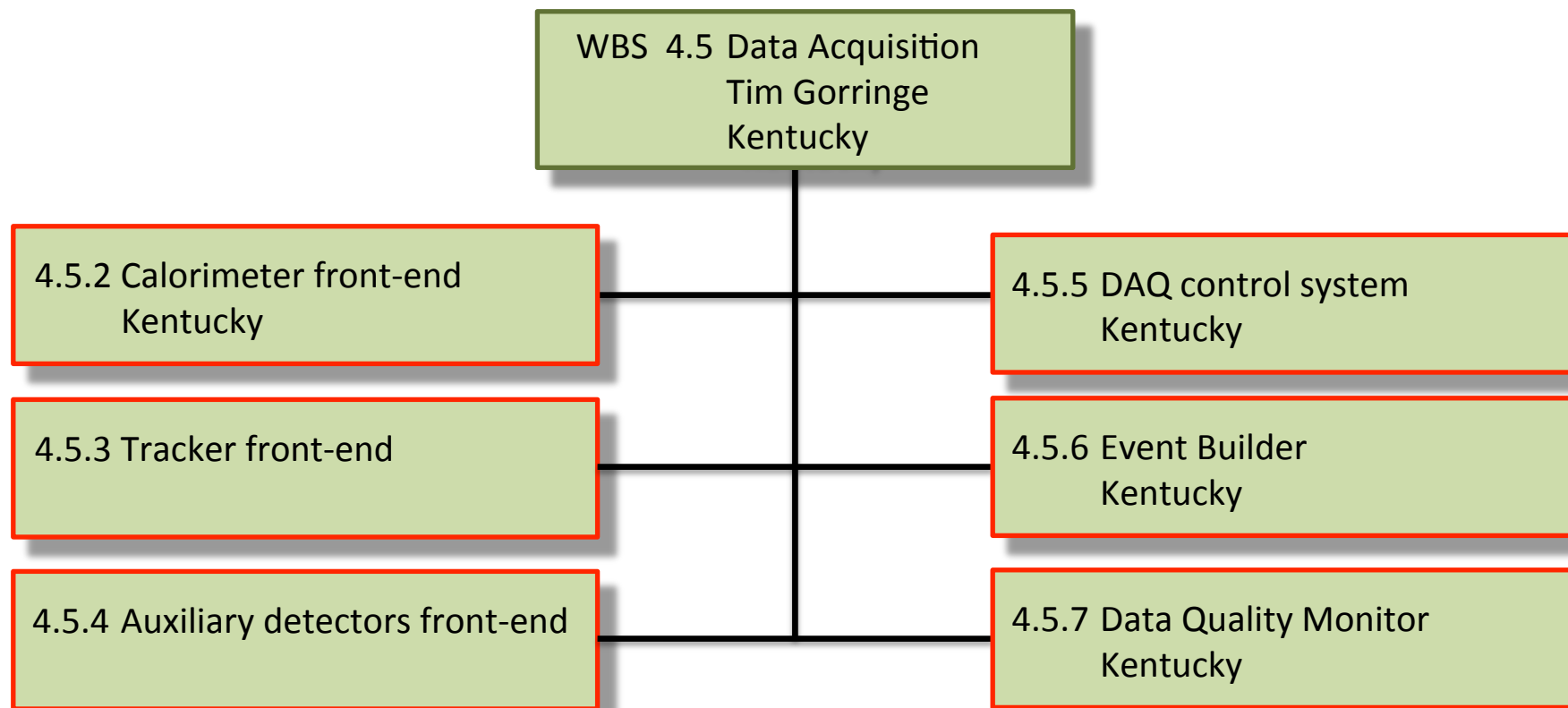


Back-end electronics Scope



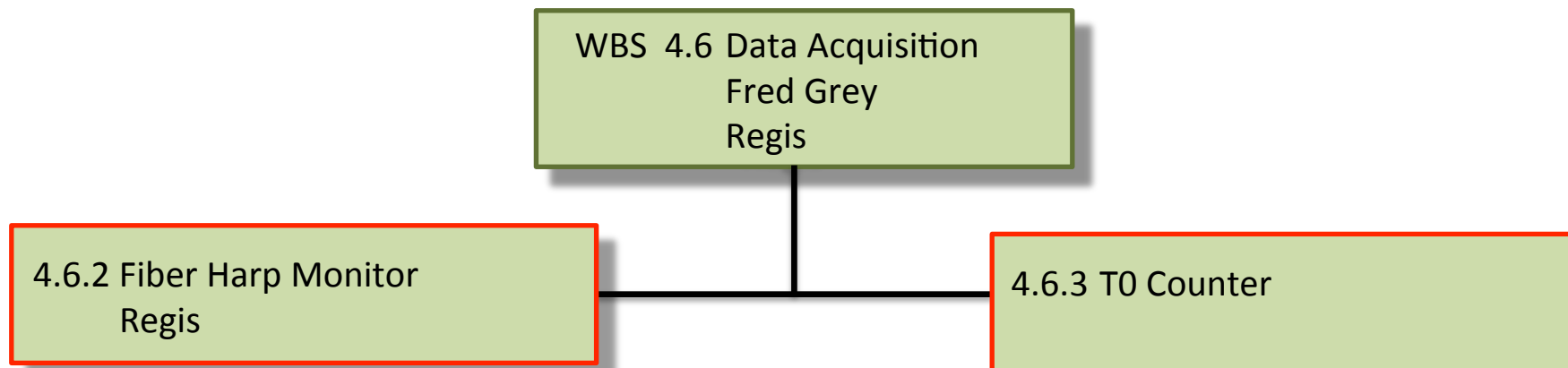


DAQ Scope



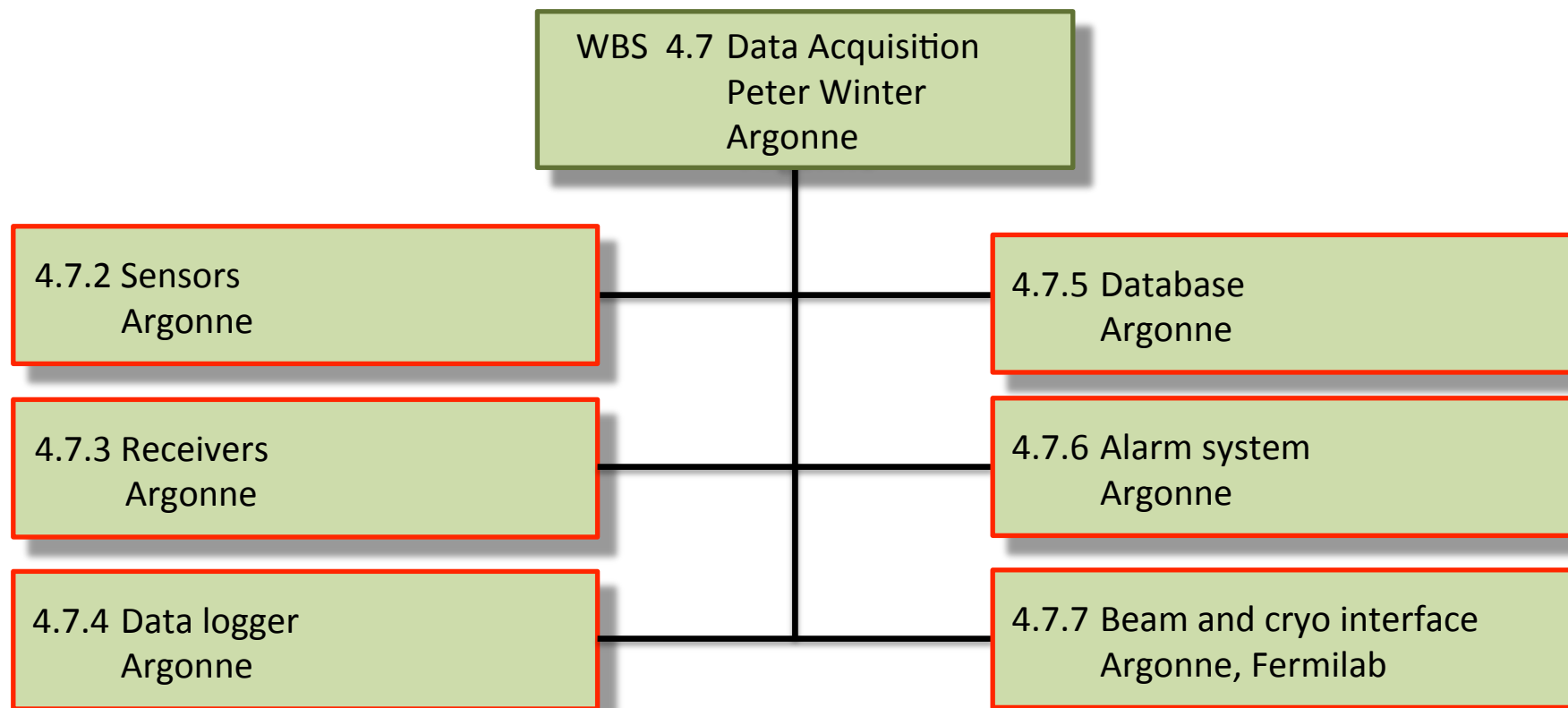


Auxiliary Detectors Scope





Slow Controls Scope





Progress on CDR and BOEs



- Went through a down selection exercise last Spring/Summer
 - Included performance results from beam tests and full simulation
 - Included both M&S and labor estimates
- Calorimeter:
 - **PbF2** versus W SiFi
 - **SiPM** versus PMT
- Tracker:
 - **Straws** versus Si strips or Si pixels
- Back-end electronics:
 - **500 MHz** versus 1 GHz wave form digitizers
- Auxilliary detectors
 - **Fiber harp system required**
 - Separate detector for muon loss not required
- This will be documented in the CDR and BOEs
 - But this process is just starting



Progress on MRI



- NSF MRI is being submitted in January
 - ~\$4M including 30% matching and in-kind contributions
 - Funds 3 out of 6 L3 boxes
 - Calorimeter, back-end electronics, data acquisition
- Institutions:
 - Washington (lead), Cornell (lead), Kentucky, Illinois, Virginia, James Madison
 - Multi-disciplinary team including low energy nuclear, medium energy nuclear and EPP groups
- Each university is only allowed to apply for 3 MRIs each year so the first step is an internal competition
 - Muon g-2 proposal ranked 1st out of all proposals submitted to University of Washington including all areas funded by the NSF
 - Cornell ranking takes place in December.
- Large overlap between requirements for CD1/2/3 and MRI
 - Conceptual design, baseline cost required in proposal
 - Proposal award is equivalent to CD3



CDR progress



WBS	1 st draft	reviewed	collaborati on review	final
4.2 Calorimeters	MRI			
4.3 Trackers	In progress			
4.4 Backend electronics	MRI			
4.5 Data acquisition	MRI			
4.6 Auxiliary detectors	In progress			
4.7 Slow controls	In progress			



BoE progress (Calorimeters)



WBS	responsibility	activities defined	costing	risks listed	reviewed	sign off
4.2.2 Crystals	D Hertzog	2 nd pass	In progress			
4.2.3 Front-end electronics	D Hertzog	2 nd pass	In progress			
4.2.4 Mechanical systems	D Hertzog	2 nd pass	In progress			
4.2.5 low voltage dist.	D Hertzog	2 nd pass	In progress			
4.2.6 Calibration system	G Venanzoni	1 st pass	In progress			



BoE progress (Trackers)



WBS	responsibility	activities defined	costing	risks listed	reviewed	sign off
4.3.2 Tracking stations	B Casey	2 nd pass	In progress			
4.3.3 Front-end electronics	B Casey	2 nd pass	In progress			
4.3.4 Vacuum mods.	B Casey	2 nd pass	In progress			
4.3.5 High voltage	B Casey	2 nd pass	In progress			
4.3.6 Gas	B Casey	2 nd pass	In progress			



BoE progress (BE Electronics)



WBS	responsibility	activities defined	costing	risks listed	reviewed	sign off
4.4.2 WFDs	L Gibbons	2 nd pass	In progress			
4.4.3 micro-TCA crate	L Gibbons	2 nd pass	In progress			
4.4.4 Tracker AMC card	B Casey	2 nd pass	In progress			
4.4.5 Clock distribution	K Pitts	2 nd pass	In progress			



BoE progress (DAQ)



WBS	responsibility	activities defined	costing	risks listed	reviewed	sign off
4.5.2 Calo front-end	T Gorringer	2 nd pass	In progress			
4.5.3 Tracker front-end	T Gorringer	2 nd pass	In progress			
4.5.4 Aux det front-end	T Gorringer	2 nd pass	In progress			
4.5.5 DAQ control system	T Gorringer	2 nd pass	In progress			
4.5.6 Event builder	T Gorringer	2 nd pass	In progress			
4.5.7 Data quality monitor	T Gorringer	2 nd pass	In progress			



BoE progress (Aux detc)



WBS	responsibility	activities defined	costing	risks listed	reviewed	sign off
4.6.2 Fiber harp monitor	F Grey	2 nd pass	In progress			
4.6.3 T0 counter	F Grey	1 st pass	In progress			



BoE progress (Slow controls)



WBS	responsibility	activities defined	costing	risks listed	reviewed	sign off
4.7.2 Sensors	P Winter	1 st pass	In progress			
4.7.3 Receivers	P Winter	1 st pass	In progress			
4.7.4 Data logger	P Winter	1 st pass	In progress			
4.7.5 Database	P Winter	1 st pass	In progress			
4.7.6 Alarm system	P Winter	1 st pass	In progress			
4.7.7 Beam/cryo interface	P Winter	1 st pass	In progress			



Risks



Risk	Owner	Type	Prob.	Level of Impact	Impact	Mitigation
MRI grant unsuccessful	Hertzog, Gibbons	cost	low	\$3M	Increased TPC	Need good communication between DOE and NSF
Detector electronics perturb precision field beyond shimming capabilities	Hertzog, Casey, Gibbons	Cost, schedule	low	high	Cannot start experiment	Small precision test magnet in TD commissioned last summer. Large MRI test magnet being shipped from LANL
Muon yield into ring much higher than expected	Convery, Casey	schedule	low	low	Less than optimal use of protons	Simulations, beam tests, adequate padding



Opportunities



Opportunity	Owner	Type	Prob.	Level of Impact	Impact	strategy
Possibility to recycle 1000 PbF2 crystals from completed experiment	Hertzog	cost	low	high	Lower cost	Spare crystals being shipped to SIC to evaluate feasibility of cutting and polishing
Expression of interest from consortium of groups in England	Roberts, Casey	cost	mod	mod	~0.5 M in kind contributions to detector systems	Tasks are being defined and they are submitting funding request
Muon yield into ring much higher than expected	Convery, Casey	schedule	low	high	Have the ability to run at different occupancies	Simulations, beam tests, adequate padding